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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Revision of the Commission's	)	CC Docket No. 94-102
Rules to Ensure Compatibility	)	ET Docket No. 99-300
with Enhanced 911 Emergency	)	
Calling Systems	)	

To: Wireless Telecommunications Bureau and Office of Engineering and Technology

COMMENTS OF TRUEPOSITION, INC.

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TruePosition, Inc. ("TruePosition"), by its attorneys, hereby submits its comments in response to the October 8, 1999 *Public Notice* released by the Office of Engineering and Technology ("OET") and the Wireless Telecommunications Bureau ("WTB") in the above-captioned proceeding.[1] The *Public Notice* seeks comments on how to verify carriers' compliance with the Automatic Location Identification ("ALI") rules, as revised in the *Third Report and Order*.[2]

I. INTRODUCTION AND SUMMARY

TruePosition agrees with the Commission's determination in the *Third Report and Order* that the best way to ensure implementation of Phase II is to provide guidance, but not

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1 *Information Sought on Methods for Verifying Compliance with E911 Accuracy Standards*, *Public Notice*, DA 99-2130 (rel. Oct. 8, 1999) (hereinafter "*Public Notice*").

2 *Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems*, FCC 99-245 (rel. Oct. 6, 1999) (hereinafter "*Third Report and Order*").

to set rigid technical standards.[3] Detailed methods for verifying compliance with the Commission's E911 rules would best be resolved by the Telecommunications Industry Association ("TIA"), a recognized technical standards body. TIA could refine compliance testing standards over time with the cooperation of the emergency services community, CMRS carriers and location technology vendors. For instance, as carriers launch E911 technology, carriers and Public Safety Answering Points ("PSAPs") will learn the types of areas in their markets where most wireless 911 calls are made and the general proportional distribution of wireless 911 calls among such areas. TruePosition has monitored markets where its system is deployed for the purpose of characterizing the density of 911 calls across a given geographic area, and other carriers and ALI vendors can do the same in their respective markets. As this data is accumulated, carriers can modify their testing methodology so that the test locations better reflect the location and frequency of actual wireless 911 calls in their service areas.

A single statistical model or operational standard for verifying compliance is inappropriate because of variations among carriers' service areas, including RF environments, population density and topography, and the differences among location technologies that carriers will implement. Any guidelines should allow enough flexibility to accord carriers discretion in adapting testing methodologies to the specific conditions in their markets.

Nonetheless, the Commission has charged OET and WTB with providing guidance on the methods of determining compliance. TruePosition therefore submits these

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[3] *Third Report and Order* ¶ 83.

recommendations regarding the issues raised in the *Public Notice*. In sum, TruePosition recommends that OET and WTB provide guidance to TIA, which can, in turn, develop more detailed testing methodologies. The guidelines should direct that test locations be proportionate to the density and location of actual wireless 911 calls to ensure that carriers are reliably providing location technology where it is most needed, i.e., that test ALI performance accurately reflects real-world ALI performance. In addition, any compliance testing standards should include a time-to-location-fix element to ensure that location information can be delivered to the PSAP in sufficient time both to route the call to the proper PSAP and to enable the call taker promptly to locate the caller. Finally, the guidelines should accord carriers discretion reasonably to tailor the testing methods to the conditions within their service area.

II. STATISTICAL CONSIDERATIONS

- **How many measurements must be made within a carrier's service area to ensure statistical confidence?**

A standards group should determine the number of measurements necessary within a carrier's service area to ensure statistical confidence. This number should depend on such factors as coverage area, geography, and RF environment rather than an inflexible "one-size-fits-all" approach. Carriers should generally use the same care to verify compliance as used to verify RF coverage in any given market.

For instance, TruePosition tests its live networks in Houston (70 cell sites) and Philadelphia (125 cell sites) regularly. Field test procedures involve multiple drive test

teams and more than 100 distributed test points across each coverage area.[4] Each drive test team moves methodically from one test point to another and executes ten or more calls at each test point. In TruePosition's experience, the number of test points that achieve statistical significance for both the Houston and Philadelphia network is 100 to 200 test points, and a typical day's testing involves the execution of 1,000 to 3,000 test calls. This is but one example of how a carrier can confirm its compliance with the Phase II rules.

- **Should a test procedure include a precisely defined statistical model?**

No. TruePosition recommends that each carrier be authorized to develop market-specific test procedures that focus on the geographic distribution and density of actual wireless 911 calls in a particular market as opposed to a generic statistical test requirement.

- **What special statistical considerations, if any, should be introduced to handle "outliers" (*e.g.*, measurements made where no fix was obtained at all, or large errors in location suspected to be due to faulty test equipment)?**

The *Third Report and Order* addressed the issue of outliers by adopting 67% and 95% data set selection criterion. Specifically, the extreme outliers and "missed" locations will be among the disregarded 33% and 5% data points. An effort to re-integrate outliers and missed calls into any test methodology would therefore undermine the purpose of the change from the previous RMS model.

- **What measurement precision should be required, *i.e.*, should the actual caller location be recorded with a precision allowing calculations to be made in fractions of a meter?**

TruePosition sees no substantial advantage in using fractional meter accuracy. The Commission's standard permits minimum error thresholds in the 50- to 100-meter range,

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[4] *See infra* p. 5-9 for how these locations are selected.

depending on the ALI technology deployed. Therefore, fractional meter accuracy produces no substantial added benefits.

III. CHOICE OF MEASUREMENT LOCATIONS

- **Should a test procedure include the entire advertised coverage area of a wireless service provider? Should test locations be organized according to the respective responsibilities of public safety answering points (PSAPs)? And if a call cannot be completed at a particular test location, should that location be ignored?**

First, test procedures should include only areas where actual call completion is possible, which usually will not coincide exactly with a carrier's advertised or authorized coverage area. The Phase II rules require CMRS carriers to provide location information only for completed 911 calls. While the rules require CMRS carriers to provide location information reliably and accurately, the rules do not require them to complete 911 calls themselves with any greater degree of reliability than non-911 calls.[5] Thus, for purposes of verifying compliance with Phase II rules, locations where calls cannot be completed (*e.g.*, dead spots) should be ignored.

Second, test procedures should not be organized according to PSAP geographic responsibilities. Rather, compliance should be determined by measuring a carrier's ALI performance throughout the carrier's licensed service area. Carriers have designed their systems over many years to enable wireless users to initiate and receive wireless calls based upon user demand, subject to the restrictions in designing any wide-area wireless system.[6] Determining compliance separately within each PSAP area would be inconsistent with how

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5 *Third Report and Order* ¶ 85 ("[W]e recognize that in some instances, calls cannot be completed and ALI cannot be provided.").

6 These restrictions include tower site availability, foliage, and man-made structures such as buildings, tunnels, etc.

carriers have designed their systems and would be tantamount to adding a new element to the Phase II rules, *i.e.*, requiring carriers to locate 67% and 95% of all 911 calls to within certain degrees of accuracy within each separate PSAP jurisdiction, not just within their service areas.

Nevertheless, PSAPs can play an important role in enabling carriers to verify compliance. Specifically, test points could be selected by wireless carriers and location technology vendors with support from the PSAP community. The support from the PSAP community could consist of identifying the general distribution and frequency of wireless 911 calls across a given geographic area. In any event, test locations should be statistically relevant to where 911 calls are made, which will not necessarily correlate with PSAP boundaries.

- **How should test locations be chosen?**

  —Should test locations be picked in a purely random fashion? If so, should they be chosen by reference to a rectangular grid of cells? If so, should measurements be made at the intersecting points within the grid, or should a certain number of points be made within each cell (*e.g.*, in proportion to the carrier's current distribution of calls, 911 calls only)? In any case, how large should cells be?

Test locations should not be picked in a purely random fashion because 911 calls are not distributed randomly. The data taken from the 1997 TruePosition/Comcast 911 trial with the State of New Jersey shows that 911 calls are distributed in a decidedly non-uniform fashion. In that trial, the following wireless 911 call distribution was generated with support from the emergency response community:[7]

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[7] The community included TruePosition, SCC Communications, Rockwell Telecommunications, KML Technologies, and others.

52% limited access roads (interstate highways)
26% major state highways (generally 4 or more lanes)
12% other designated commuter routes (state, county, or municipal identified roads)
10% residential and commercial areas (outdoor roads, parking lots, driveways, yards, in building interiors)

Thus, to ensure that location technology is reliable and accurate in those geographic areas where consumers depend on it the most, carriers should concentrate tests in locations where most wireless 911 calls have been made. For example, location test points could be selected along specific traffic corridors with a linear distribution proportional to the density of historical 911 calls made within the same corridor. Alternatively, carriers could develop a market-wide or cell-by-cell grid, identifying points within the market or cells where actual wireless 911 calls have been made. Test locations could then be plotted in proportion to actual distribution of where 911 calls in that market originate. Over time a carrier will gather more data on the locations of 911 calls and can further tailor its choice of testing locations to each market. Finally, test locations should be based on the types of areas where wireless *911* calls originate, not where all wireless calls in general originate.

> **—Should test locations be picked by reference to irregularly bounded areas, such as the estimated coverage areas of individual base stations? If so, how far should test locations be from the base stations and, especially for network-based systems, should tower configuration be a consideration in determining test locations (*e.g.*, test locations directly between two towers, equidistant between three towers, etc.)?**

As discussed above, test locations should be plotted in proportion to the geographic distribution of actual wireless 911 calls. Such a distribution would, secondarily, incorporate a variety of locations, such as base stations, tunnels, highways, or urban canyons.

Any guidelines, however, should specify only that test locations be chosen in relation to actual 911 call locations.

> **—Should test locations be classified by the type of reception environment (on a sidewalk, in a vehicle, in a building, rural, urban, suburban, etc., or with reference to parameters of predictive ALI models)? How would such areas be defined? What techniques are practical and appropriate to assure randomness, if needed?**

Again, there is merit to modeling the type of reception environment only to the extent that it is in reference to the proportion of actual 911 calls made from various reception environments. The PSAP community can provide a valuable service by identifying the types of environments from which actual 911 calls originate. The construction of a specific environment model, if any, should be left to the appropriate standards bodies with participation by the emergency services community, wireless carriers and location technology vendors.

> **—Should tests be made on various floors of a building, *i.e.*, should there be a vertical dimension to the test procedure?**

The Phase II rules do not require reporting of altitude, and therefore vertical testing should not be an element of any required test methodology.

- **How should the test procedure recognize changes that occur over time in the test area, such as foliage changes and construction of new buildings?**

E911 testing should be periodic and could be combined with regular, periodic drive testing of the carrier's system (although E911 testing need not necessarily be repeated with the same frequency as standard RF drive testing). A standards body could best determine an appropriate minimum interval for periodic E911 testing.

IV. MEASUREMENT TECHNIQUES

- **Should there be a maximum time to obtain a location fix? If so, what criteria are appropriate for setting this time limit (*e.g.*, the typical time for call to be routed to a PSAP, some period of time *after* the call has been routed to the PSAP, etc.) and should such criteria vary for different test locations?**

The importance of a time limit to obtain a location fix cannot be understated. Timing is critical for two reasons: (1) giving the PSAP call taker adequate time to determine the caller's location and promptly dispatch emergency personnel to the 911 caller's location, and (2) ensuring that the 911 call is selectively routed to the appropriate PSAP based upon Phase II location data.[8] TruePosition's technology supports selective routing because it obtains a location fix within the same time it takes CMRS carriers generally to process a call—within 2 to 4 seconds of the caller pressing "9-1-1 SEND," the time required by current 911 network equipment (i.e., tandems and routers).

The compliance testing standard should incorporate a time limit short enough to support timely selective routing yet long enough to accommodate differing technologies. (Currently, the time limit in most U.S. 911 networks is generally two to four seconds.) This time period should be independent of whether a carrier deploys a network- and/or handset-based ALI solution, and there should be no differentiation for different test locations.

- **For GPS-based systems, should some or all location attempts be made from phones that have not acquired a recent location fix (*i.e.*, a "cold start")?**

For carriers deploying GPS-based ALI systems, a number of measurement calls should be made from a cold start proportionate to the number made in actual wireless 911

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[8] *See Third Report and Order* ¶ 2 ("ALI can be applied to route these calls immediately to the proper PSAP, normally that nearest the scene."). Basing call routing on Phase I information only can have a significant error rate.

call scenarios for the carrier's given market. The guidelines should establish clear definitions of "cold," "warm" and "hot" starts.

- **Should both portable and mobile phones be tested? If so, in what proportion? Should the test procedure specify how portable phones should be oriented, or how a mobile antenna should be mounted?**

For handset-based ALI systems, the type and orientation of CMRS phones are relevant for testing purposes. When a portable handset using a GPS-based technology is used in a vehicle, GPS satellite signals could be blocked by the roof of the car. (The same is true for portable phones used on a belt clip (*e.g.*, with an earpiece/microphone attachment), indoors, or even, if cupped in the user's hand and pressed up against the user's head.) Accordingly, the test procedures should require that portable (and mobile) phone antennas be oriented in accordance with most common and accepted CMRS user practices.

For network-based systems, however, the type of phone used is not relevant. The phone either has the power needed to establish call completion (and is subsequently a useable call test case) or it does not have adequate power to complete a call (and the test call cannot be counted). Nevertheless, testing portable and mobile phones in proportion to their usage in a carrier's market, even for network-based ALI systems, would be appropriate to ensure compliance with real-world scenarios.

- **Should some proportion of measurements of portable phones be made with phones in motion (*i.e.*, at walking speeds)? If mobile phone measurements are made, at what speeds should the mobile unit be moving?**

Yes, the proportion of tests involving phones in motion should model the proportion of actual 911 calls made from moving phones.

- **If a carrier provides both analog and digital service, should separate tests be prescribed for each mode? Should the accuracy and reliability standards apply separately to each mode, or should the test results be combined in some specific proportion?**

To the extent that carriers provide services using different air interfaces within their systems, they should have flexibility to adopt different testing methodologies for each protocol. The CMRS carrier should also be able to elect to report accuracy numbers separately for analog and digital or to report the overall accuracy statistic as a merger of the analog and digital accuracy test results in proportion to the actual incidence of 911 calls on analog and digital channels made in its system.

- **What techniques are available for determining the distance between the actual location and the measured location?**

Carriers should have discretion to adopt reasonable methods of ascertaining ground truth using the WGS-84 geodetic reference.[9]

- **Is there a need to develop a different test procedure for network vs. handset technologies?**

Because the Phase II requirements in some respects differ based upon the type of location technology a carrier deploys, different test procedures may be required to the extent necessary to verify compliance with such different requirements. The standards body should determine the extent to which different handset- and network-based test procedures are necessary.

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[9] "World Geodetic System (WGS-84)," MIL-STD-2401, United States Department of Defense, 1984; "World Geodetic System 1984 (WGS-84) Technical Report (and supplements)," DMA TR 8350.2, Defense Mapping Agency, Second Edition, 1 September 1991.

- **Should provisions be made for the use of predictive models of ALI systems, now or in the future? If so, what accuracy and reliability standards should be required of such models and how should they be tested?**

  TruePosition discourages the use of predictive models, which can be unreliable.

V. CONCLUSION

TruePosition agrees with the Commission that the best way to ensure implementation of Phase II is to provide guidance, but not to set rigid technical standards. A recognized technical standards body, such as the TIA, could refine compliance testing standards over time with the cooperation of the emergency service community, CMRS carriers and location technology vendors. A single statistical model or operational standard for verifying compliance would be inappropriate, and any guidance should be flexible enough to accord carriers discretion in adapting testing methodologies to the specific conditions of their markets.

Respectfully submitted,

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